African Invertebrates Vol. 47 Pages 117–134 Pietermaritzburg December, 2006

Natalimyzidae, a new African family of acalyptrate flies (Diptera: Schizophora: Sciomyzoidea)

David A. Barraclough[1] and **David K. McAlpine**[2]

[1]School of Biological & Conservation Sciences, Howard College, University of KwaZulu-Natal, Durban, 4041 South Africa, and Natal Museum, P. Bag 9070, Pietermaritzburg, 3200 South Africa; barracloughd@ukzn.ac.za; [2]Australian Museum, 6 College Street, Sydney, NSW 2010, Australia

ABSTRACT

The Natalimyzidae, a new African family of acalyptrate Diptera in the superfamily Sciomyzoidea, is established for *Natalimyza* gen. n. and a single new species, namely *N. milleri*, from Van Reenen's Pass and Giant's Castle Game Reserve in the KwaZulu-Natal Drakensberg mountain range, South Africa. The family is, however, known to be widespread in Africa, with current records being South Africa (Western Cape, Eastern Cape, KwaZulu-Natal, Mpumalanga, Limpopo), Zimbabwe, Kenya and Nigeria. Natalimyzidae are mainly found in grassland, and in South Africa the family is most often collected during the dry, winter months in the eastern summer rainfall region. The larvae appear to be microflora grazers on decaying grass. Numerous additional new species of these small flies (approx. 2.5–4.5 mm long) await description; a likely total of more than 30 species could be expected. The Natalimyzidae is the first widespread new family of Diptera described entirely from new African taxa. The relationships of *Natalimyza* with other schizophoran superfamilies are discussed, and the genus is referred to the Sciomyzoidea. A detailed review of all families of Sciomyzoidea suggests no definite sister group relationship with *Natalimyza*, and the new family is provisionally treated as *incertae sedis* within the superfamily.

KEY WORDS: Diptera, Schizophora, Sciomyzoidea, Natalimyzidae, new family, Africa, grassland.

INTRODUCTION

Africa has an enormously diverse and speciose fauna of acalyptrate Diptera, the study of which seems constantly to unearth unexpected findings. For the Afrotropics as a whole, 4500 to 5500 new acalyptrate species or more await description in some 45 families, with many of these families very poorly studied and their relationships inadequately resolved (species data from Stuckenberg & Kirk-Spriggs pers. comm.). This said, however, the discovery and naming of an additional new family, based entirely on African taxa, is unprecedented (see also Buck 2006). The Natalimyzidae is the first widespread new family to be described solely on new African acalyptrate flies; the relatively recently described Marginidae for example, included a Madagascan species (D.K. McAlpine 1991*c*), and is known from only two localities (see also Barraclough 1994). The recognition and description of the Natalimyzidae is thus a landmark in African dipterology. Unlike the Marginidae, Natalimyzidae is not a rarely collected taxon, and there is increasing evidence that the family is widespread and relatively speciose in Africa; a total fauna of more than 30 species could be expected, with about 20 species present in South Africa alone. For this study we have seen material from much of southern and eastern South Africa (Western Cape, Eastern Cape, KwaZulu-Natal, Mpumalanga, Limpopo) and Zimbabwe, but we have previously seen specimens from Nigeria and Kenya. However, much more focused collecting is indicated; in South Africa for example, almost 90% of material was collected in a single province, namely KwaZulu-Natal. The family is not expected to be represented in Madagascar owing to the secondary nature of much of the grassland (Stuckenberg pers. comm.), and it is thus likely to be an African endemic.

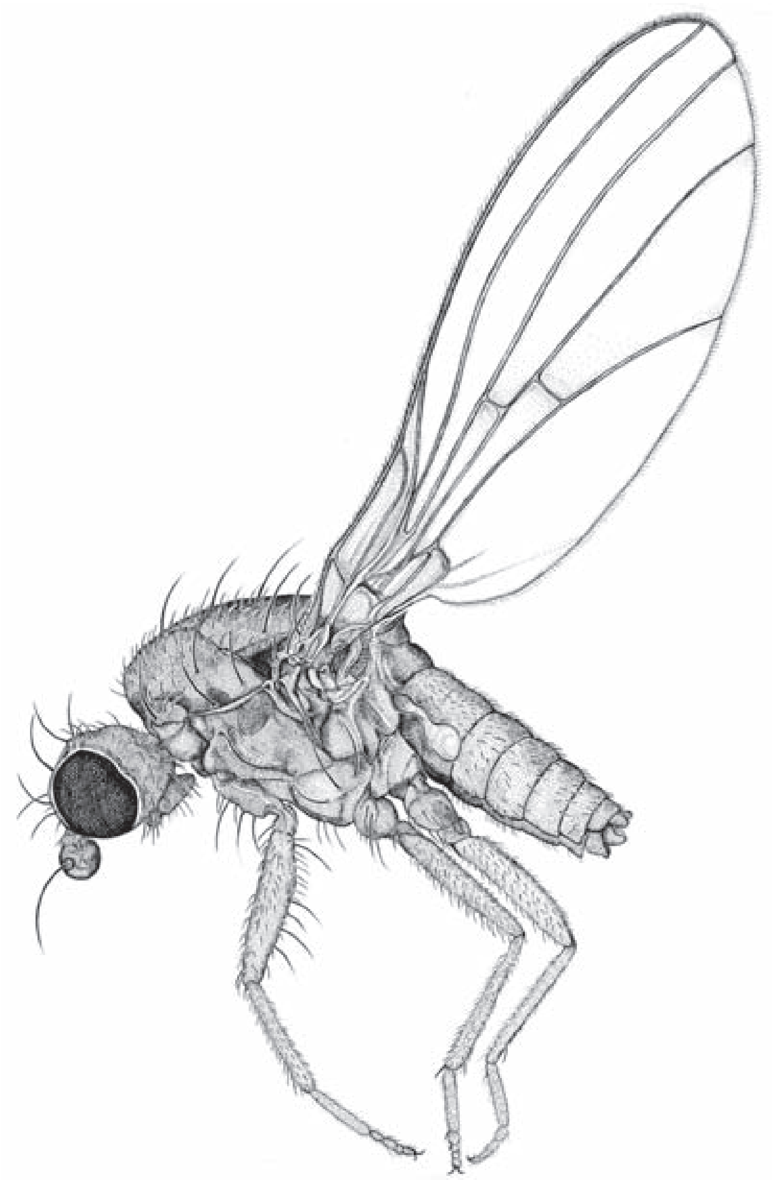


Fig. 1. Habitus of *Natalimyza milleri*, female (Van Reenen's Pass).

The first known specimen of Natalimyzidae was collected at Mt Chirinda in south-eastern Zimbabwe in May 1911. Additional material was unknowingly collected over the next 48 years, but it was only in March 1959 that a good series was collected by Dr Brian Stuckenberg (Entomology Department, Natal Museum) at Cathedral Peak in the KwaZulu-Natal Drakensberg mountain range. The species concerned was found only in primary grassland at the climax of its growth in late summer. Dr Stuckenberg was the first to recognise that this species in all probability represented a new family, but unfortunately over the subsequent 47 years, despite being recognised as new by several eminent dipterists, no publication was forthcoming. It was in this context, in March 2006, that Dr Stuckenberg asked us to produce this paper for the centenary volume of the Natal Museum's natural science journal *African Invertebrates* (formerly *Annals of the Natal Museum*). Our paper is dedicated to the long and proud dipterological tradition at the Natal Museum, and to Dr Stuckenberg's pioneering contribution to the study of African flies since 1953. However, we also acknowledge the contribution of all the other dipterists who work or have worked in the Entomology/Arthropoda Department over a period spanning more than five decades.

In terms of active fieldwork involving the collection of specimens and studying their biology, Dr Ray Miller (University of KwaZulu-Natal, Pietermaritzburg) has made an indelible and substantial contribution to our knowledge of this new family. About three-quarters of the more than 400 specimens in the Natal Museum collection were collected by Dr Miller. His presentation on the taxon at the 27th International Congress of Entomology (Miller 1984) is probably the first significant reference to the existence of the Natalimyzidae; the new family was also identified by Miller (Moran & Southwood 1982: 291, 304). Barraclough (1995: 112, 124) was the first to include the new family in an identification key.

The Natalimyzidae—in South Africa at least—are predominantly grassland flies, and interestingly are often collected during the dry, winter months in the eastern summer rainfall region. Miller (1984) reared the larvae, which appear to graze on the microflora of decaying grass, and are able to resist considerable desiccation. In terms of adult morphology, Natalimyzidae are distinctive within the Afrotropical acalyptrate fauna. In the field these small, yellow to brown flies (2.5–4.5 mm long, see Fig. 1) could perhaps be confused with species of Chyromyidae or Opomyzidae, but are immediately distinguished by the unusual arrangement of the four fronto-orbital bristles and several other character states (see Barraclough 1995). Although not derived from the family-group name, the vernacular name 'African grass flies' is suggested.

This paper describes the new family Natalimyzidae, the type genus and the type species. The establishment of the family name in the literature will hopefully be a departure point for focused collecting throughout Africa and a comprehensive taxonomic revision. An intensive phylogenetic study of the families of Sciomyzoidea was neither intended nor feasible in the limited time available for the completion of this paper. It is well known that there are substantial difficulties and disagreement in higher-level studies of acalyptrate families (see e.g. Yeates & Wiegmann 2005), and the Sciomyzoidea are no exception. Even at the time of writing, the family status of one of the constituent families of the wider Sciomyzoidea (Eurychoromyiidae) is under question (Gaimari 2006). It is hoped that the Natalimyzidae will be included in all future phylogenetic studies on the Sciomyzoidea, and that eventually definitive relationships will be resolved.

MATERIALS AND METHODS

Due to logistical and time constraints this paper is based almost entirely on the South African species of Natalimyzidae, deposited in the Natal Museum. External characters were reviewed based on examination of selected species from the different provinces. This process was repeated for structures of the male postabdomen. The female postabdomen was examined from three different species.

We have considered the cyclorrhaphous antenna to be primarily 6-segmented, and have numbered the segments accordingly in our descriptions. Segments 4–6 constitute the arista, and, when segment 4 is obsolete as in *Natalimyza*, the numbering of the more distal segments is unchanged. These divisions of the arista are sometimes termed aristomeres, a redundant term of mixed derivation. The hypofacial, as referred to in the text, is the ventrolateral extension of each side of the face below the genal region.

Body length was measured from the base of the antennae to the abdominal apex, and wing length from the humeral crossvein to the wing-tip. Standard techniques were used for postabdominal dissections, all of which are stored in glycerine, in microvials pinned beneath source specimens. Illustrations are not all to scale and are drawn at arbitrary, convenient sizes.

Holotype label data are quoted exactly as they appear; a single forward slash marks the end of a line, and a double forward slash denotes the end of a label and the beginning of another. The holotype and type series of *N. milleri* sp. n. is deposited in the Natal Museum, Pietermaritzburg. However, 1♂ and 1♀ paratypes are deposited in each of the following collections: Australian Museum (Sydney); National Museum of Natural History (Washington); the Natural History Museum (London). All specimens are mounted on points. A special effort was made to label all the figures as comprehensively as possible, in order to facilitate understanding by a broader, inter-disciplinary audience. The first and second anal veins are referred to as veins 6 and 7 in the Relationships section at the end of the paper.

TAXONOMY

Family **Natalimyzidae** fam. n.

Type genus: *Natalimyza* gen. n.

The following combination of character states should distinguish the Natalimyzidae from all other families of acalyptrate Schizophora:

Fully winged flies with well developed palpus and proboscis; fronto-orbital plate broad, with 2 large reclinate bristles and one or two proclinate bristles; postvertical bristles convergent; face uniformly sclerotised; antennal segment 2 without dorsal slit; arista bare, inserted dorsolaterally on segment 3; prothorax very short, without sclerotised precoxal bridge; metathoracic postcoxal bridge absent; thoracic bristles including the following: normally 4 dorsocentrals, presutural, 1+1 notopleurals, 2 pairs scutellars (basal pair reduced), 2 to 5 upper sternopleurals (no propleural or mesopleural); each tibia with one preapical dorsal bristle; tarsi long and slender; costa unbroken, other veins without macrotrichia; subcosta complete, typically diverging from vein R_1 distally; vein R_{2+3} terminating close to end of vein R_{4+5}; discal, second basal and anal cells complete, the latter two rounded distally; vein A_1 vestigial beyond anal cell; vein A_2 visible well beyond alula, desclerotised; alula moderately developed; pre-abdominal spiracles in pleural membrane; protandrium very asymmetrical, with tergite 6, and sternites 6, 7 and 8 well developed; surstylus fused to epandrium; aedeagus, and particularly its distiphallus, short; female postabdomen simple; cerci separate.

A detailed morphological description is given for *Natalimyza*, the only included genus.

Genus **Natalimyza** gen. n.

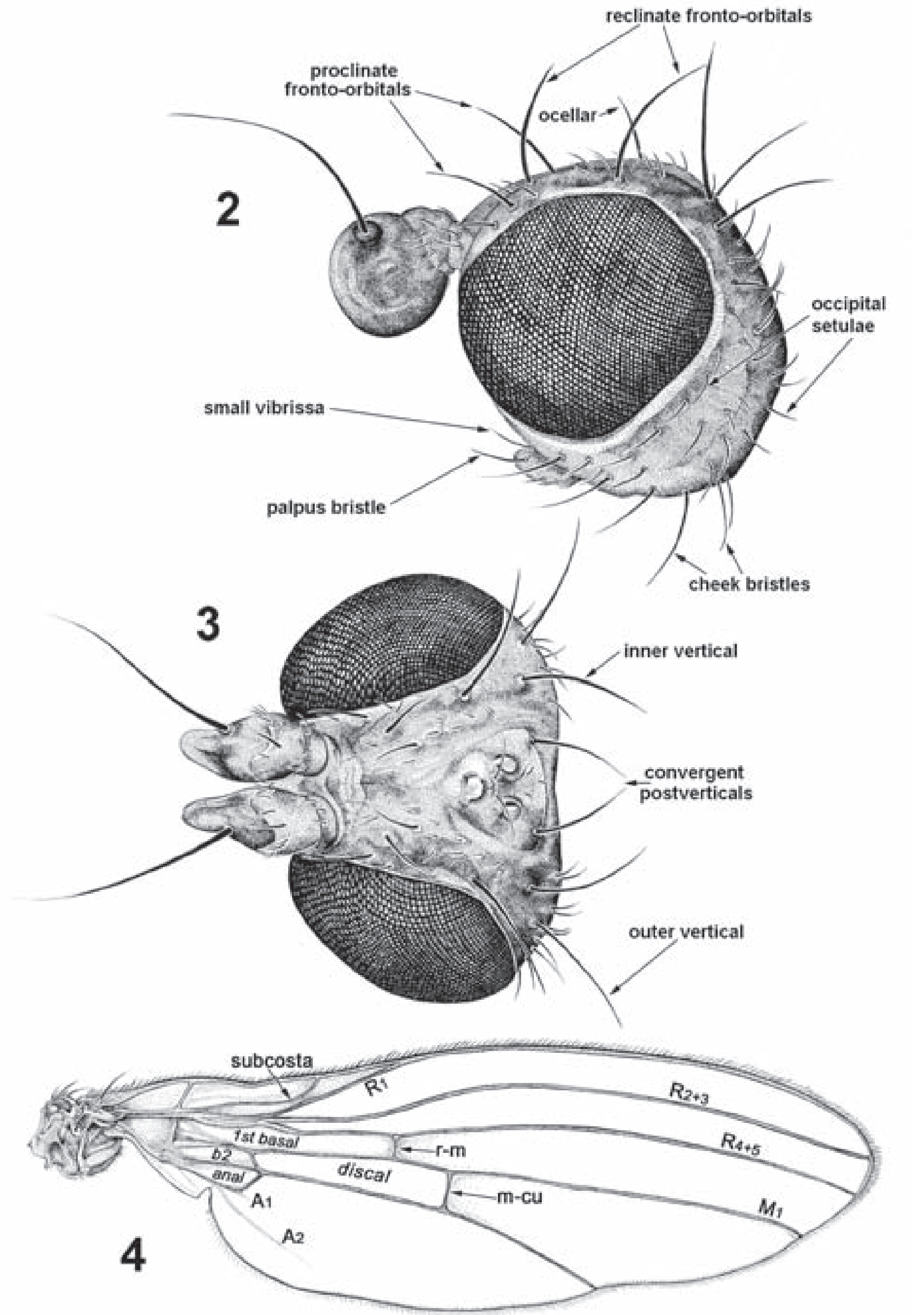
Type species: *Natalimyza milleri* sp. n.

Etymology: The family name refers to the Natal Museum, as well as the province formerly named Natal, where significant numbers of this taxon were first discovered and studied. Almost 90% of South African material seen by us was collected in KwaZulu-Natal. Gender feminine.

Description: Moderately elongate, rather small flies resembling in habitus such genera as *Opomyza* Fallén (Opomyzidae) and some Clusiidae, without obvious sexual dimorphism except in postabdomen; cuticle predominantly dull, pruinescent; body colour yellow to brown; wing membrane clear, unmarked.

Head (Figs 2, 3): Vertex rounded, without trace of transverse carina. Each fronto-orbital plate broad, undivided, long, but not reaching ptilinal suture. Face variably presented, ranging from relatively broad and weakly sclerotised (differentiated from peribuccal membrane), to narrowed and barely sclerotised. Hypofacial narrow, not visible in profile below cheek. Ptilinal suture medially transverse, passing closely above antennal sockets, laterally prolonged to terminate near vibrissa. Eye occasionally with inconspicuous ommatrichia. Postvertical bristles convergent, short to elongate. Fronto-orbital bristles complex in arrangement: 2 reclinate or outwardly flexed bristles, the more anterior further from eye margin, a proclinate bristle between anterior reclinate bristle and eye margin, usually a proclinate and incurved bristle near medial margin of orbital plate behind anterior reclinate bristle. Ocellar bristles divergent, usually relatively long. Vibrissa either distinct or little differentiated from a series of variably developed and positioned cheek bristles. Supra-occipital setulae in one transverse fascicle. Antenna with segments 1 and 2 short, latter without dorsal slit; segment 3 discoid; arista inserted dorsolaterally on segment 3; segment 4 desclerotised; segment 5 enlarged, subspheroid; segment 6 slender, bare. Prelabrum (= clypeus) well developed, separated but not distant from face. Palpus elongate, usually with an outstanding terminal bristle. Proboscis usually with large labella.

Thorax: Narrow and rather deep. Prothorax very short and inconspicuous. Prothoracic precoxal bridge absent. Probasisternum usually narrowly oval, always bare. Mesoscutum rather prominently gibbous anteriorly. Scutellum without setulae. Subscutellum weakly to noticeably convex, not much enlarged. Mesopleuron with callus on upper posterior margin. Wing process of pteropleuron without convex ampulla (greater ampulla of J.F. McAlpine 1981). Metepisternum attenuated dorsally (its limits sometimes not easily seen), without setulae. Margin of metathoracic spiracle without bristles or setulae. Metasternum bare. Bristles present: 1 humeral, nearly always 4 dorsocentrals, presutural, 1+1 notopleurals, supra-alar, postalar, usually 1 posterior intra-alar, 2 unequal scutellars, 2 to 5 upper sternopleurals (propleural and mesopleural bristles absent); prescutellar acrostichals occasionally present, albeit reduced. Legs of moderate length and thickness. Fore femur with long posterodorsal and posteroventral bristles; other femora without differentiated bristles. Each tibia with one preapical dorsal bristle; mid tibia with one apical ventral spur (absent on other tibiae). Tarsi slender, subequal in length to tibiae, cylindrical except for the depressed terminal segment; mid basitarsus usually slightly to noticeably shorter than hind basitarsus. Claws stout, of moderate length, usually strongly curved; pulvilli shorter than claws, rather broad, with relatively short hairs.


reclinate fronto-orbitals
proclinate fronto-orbitals
ocellar
2
occipital setulae
small vibrissa
palpus bristle
cheek bristles
3
inner vertical
convergent postverticals
outer vertical
subcosta
R1
R2+3
1st basal
r-m
R4+5
b2
anal
discal
m-cu
M1
A1
A2
4

Figs 2–4. *Natalimyza milleri*: (2, 3) head, showing detail of all vestiture: (2) profile, (3) dorsal view; (4) wing (names of wing cells italicised, *b2* – second basal cell).

Wing (Fig. 4): Rather long, with almost uniform covering of microtrichia. Costa not broken or incised, extending to vein R_{4+5} or vein M_1, with one dorsal and one ventral costagial bristle near base; on most of length with one anterodorsal and one anteroventral series of bristles, sometimes also some fine irregular hairs, and usually spinules in the anterodorsal series; other veins without macrotrichia. Subcosta distinct throughout, typically diverging from vein R_1 distally. Vein R_{2+3} long, so that vein R_{4+5} terminates nearer to vein R_{2+3} than to vein M_1. Discal, second basal, and anal cells complete. Crossveins r–m and m–cu somewhat approximated; very closely approximated in some species and positioned in basal two-fifths of wing, ranging to more broadly separated in others with crossvein m–cu positioned near mid-length of wing. Vein A_1 unbroken on anal cell, reduced to a desclerotised vestige beyond that cell. Vein A_2 visible beyond alula as a slightly pigmented, curved crease. Alula moderately developed, not sinuate on distal margin, with marginal fringe.

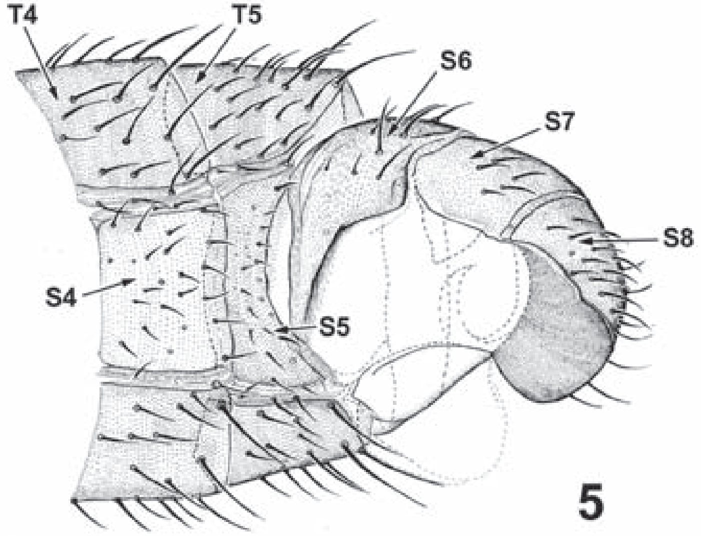
Abdomen: Elongate-ovoid, usually longer than thorax. Tergites 1 and 2 partly separated. Sternite 1 distinct, somewhat sclerotised, without setulae. Preabdominal spiracles situated in pleural membrane close to lateral margin of tergites.

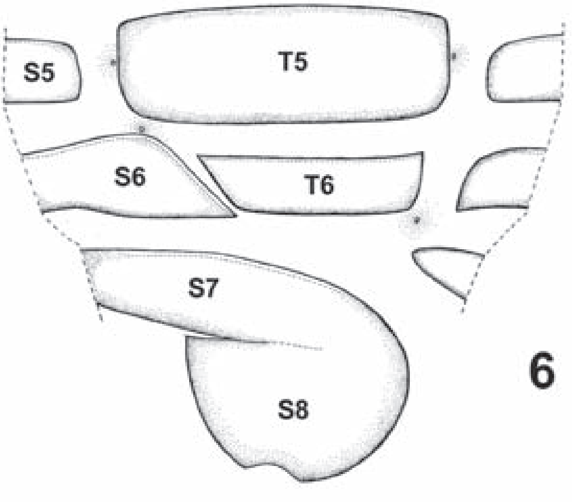
Male postabdomen (Figs 5–9): Tergite 6 asymmetrical, usually short but well developed, setulose, rarely reduced and setulae occasionally absent. Sternites 6 and 7 well developed, asymmetrical, usually partly setulose, sternite 7 broadly joined to the setulose dorsal sternite 8; sclerite probably representing tergite 7 sometimes present on right side. One pair surstyli present, immovably joined to epandrium. Hypandrium very variable in shape and size, often bearing paired spines or groupings of spines, and/or with paired projections, the latter usually slender. Paired gonites present, usually slender and elongate, flanking but basally separate from aedeagus. Aedeagus simple, with relatively elongate sclerotised basiphallus and short, membranous distiphallus. Aedeagal apodeme short, usually posteriorly directed. Sperm pump reduced. Cerci separate, variable in shape and size, nearly always conspicuous.

Female postabdomen (Figs 10–12): Without specialised elongate segments; sternites 6, 7 and 8 all separate, 6 and 7 being large; spiracles of segments 6 and 7 present in pleural membrane. Cerci separate, short, slightly to noticeably longer than tergite 8, somewhat rounded, inconspicuous. Spermathecae 2, each with separate duct from oviduct; duct expanded distally; vesicle with darkly pigmented, relatively smooth, cuticular lining.

Discussion: There appear to be two species groupings in *Natalimyza*. In the first grouping of usually pallid species, the head and eye are depressed and the proboscis is somewhat reduced in size. In these species the bristles on the dorsal part of the head are usually reduced in length and strength. In the second grouping (to which *N. milleri* belongs) the head and eye are more or less rounded in profile and the proboscis is well developed. In these species the bristles on the dorsal part of the head are elongate and well developed. This said, however, there are intermediate forms, and no generic distinction is warranted at this stage. There is also significant intrageneric variation in the positioning of the r–m and m–cu crossveins, which are very closely approximated in some species, ranging to relatively well separated in others.

We decided not to dissect the male abdomen in order to investigate internal structures such as the testes and accessory glands. We consider that a substantial number of species need to be dissected to properly assess the development and form of these structures.





Figs 5, 6. *Natalimyza milleri*, male postabdomen: (5) protandrial sclerites, ventral view (detail of dorsal structures, including tergite 6, omitted); (6) protandrogram (vestiture omitted).

Such studies are certainly indicated in future and may help elucidate phylogenetic relationships.

Natalimyza milleri sp. n.

Figs 1–12

Etymology: The species name recognises the contribution of Dr Ray Miller to our understanding of the Natalimyzidae. He was involved in collecting the entire type series.

Diagnosis:

External characters: Head usually at least partly dark; head and eye more or less rounded; frons not excavate; cheek strongly receded anteriorly; differentiated vibrissa lacking, but series of longer, anteroventrally directed cheek bristles present; medial proclinate fronto-orbital present, proclinate setula present anterior to lateral proclinate fronto-orbital towards antennal base; facial region relatively broad, width reaching length of third antennal segment in profile; palpus with apical, outstanding bristle; three (rarely four) well developed sternopleurals; four (1+3) dorsocentrals; posterior intra-alar present; costa extending to apex of vein R_{4+5}; crossveins r–m and m–cu well separated, distance 1.0–1.7 times length of m–cu.

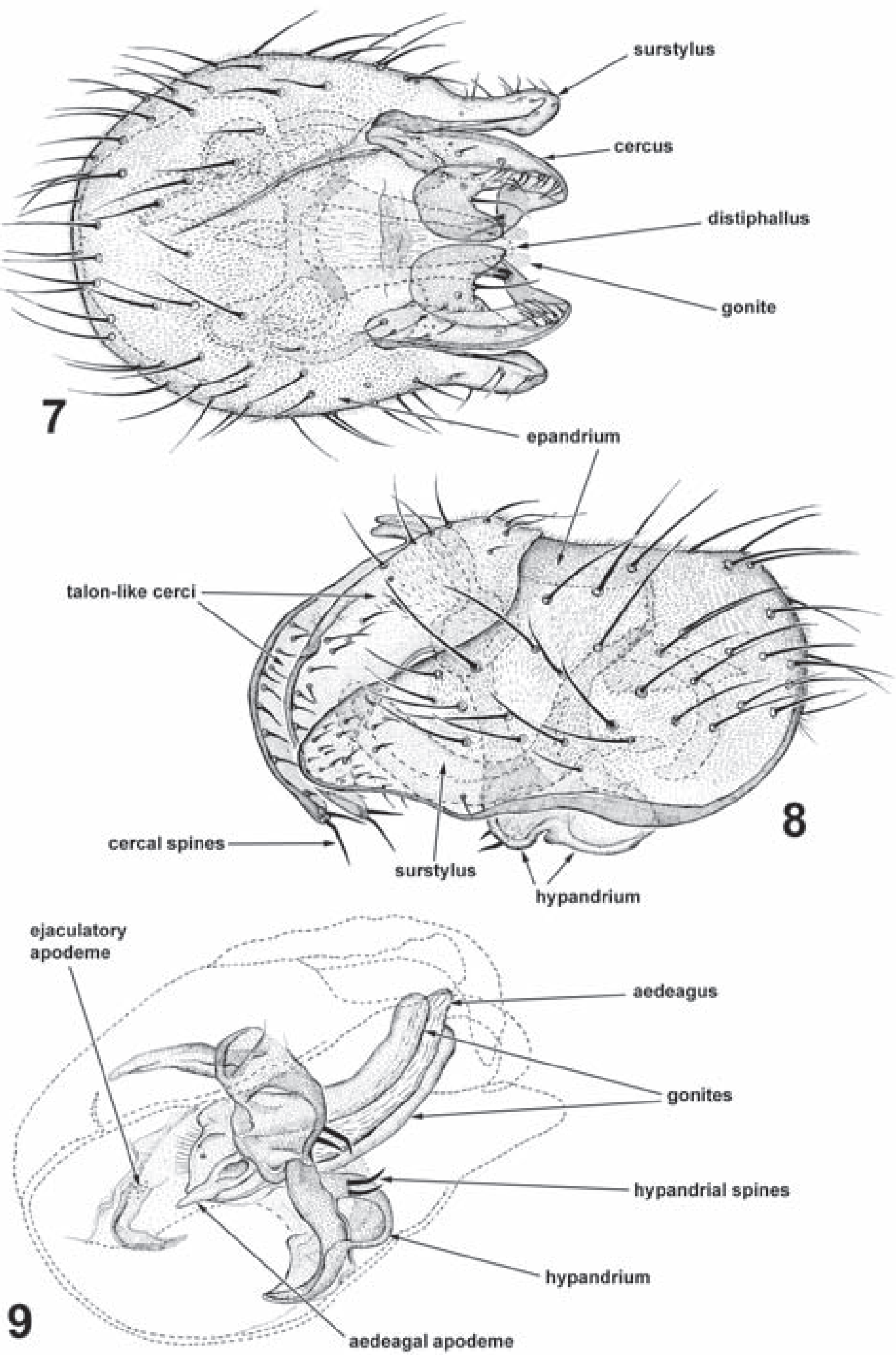
Male postabdomen: Distinguished from sibling species with a similar talon-like cercus bearing two apical spines (see Figs 7, 8) as follows: epandrium with margin unmodified, and lacking outstanding setulae; surstylus (Fig. 8) relatively broad at base, apicoventral section broadly concave such that apical half is substantially narrowed and apex acutely rounded; hypandrium (Fig. 9) with anterior section bearing two pairs of relatively weakly developed spines, these slightly longer than cercal spines, and arising directly from surface (i.e. not from protruding cuticle), typically medioventrally directed such that they oppose each other.

Description:

Dimensions (mm): Male: Body length 2.7–3.0; wing length 2.5–2.8. Female: Body length 3.1–3.6; wing length 2.8–3.5.

Colour/Pruinescence: Head (including antennae) largely yellow to yellow-brown, cheek entirely so; fronto-orbital plate, ocellar triangle, part of occiput and much of arista usually a darker brown which is overlain with silvery pruinescence. Thorax yellow-brown to brown, anterior margin of pleuron usually yellowish; pruinescence relatively dense and silver. Legs, including all tarsi, entirely yellow, noticeable pruinescence lacking. Haltere and wing veins yellow.

Head (Figs 2, 3): Somewhat rounded, not flattened in profile; eye of similar length and depth, ommatrichia not or barely evident. Cheek strongly receded anteriorly in a line anterior to medial proclinate fronto-orbital in profile; differentiated vibrissa lacking, a small anteriorly directed bristle at anterior extent of cheek (rarely duplicated), followed by series of usually three to four, but occasionally five to six, much longer bristles, these positioned towards ventral margin and anteroventrally directed; cheek otherwise often with a few anteroventrally directed setulae, which are more or less continuous with several rows of setulae on lateral part of occiput. Occiput prominent in profile; setulae on lateral margin downwardly directed, one or two rows of upwardly directed setulae medial to these, positioned from about mid-height of occiput to just behind and below verticals. Dorsal head bristles well developed; inner vertical the longest, usually markedly so. Fronto-orbital bristles: medial proclinate present; one proclinate setula present anterior to lateral proclinate fronto-orbital towards antennal base. Frons not excavate, entirely visible in profile; ocellar triangle usually just visible, with very few, short setulae. Fronto-orbital plate with scattered setulae. Antenna inserted noticeably above mid-height of eye; first segment exposed in profile. Facial region quite strongly recessed, relatively broad, width reaching length of third antennal segment in profile. Palpus with apical, outstanding bristle.

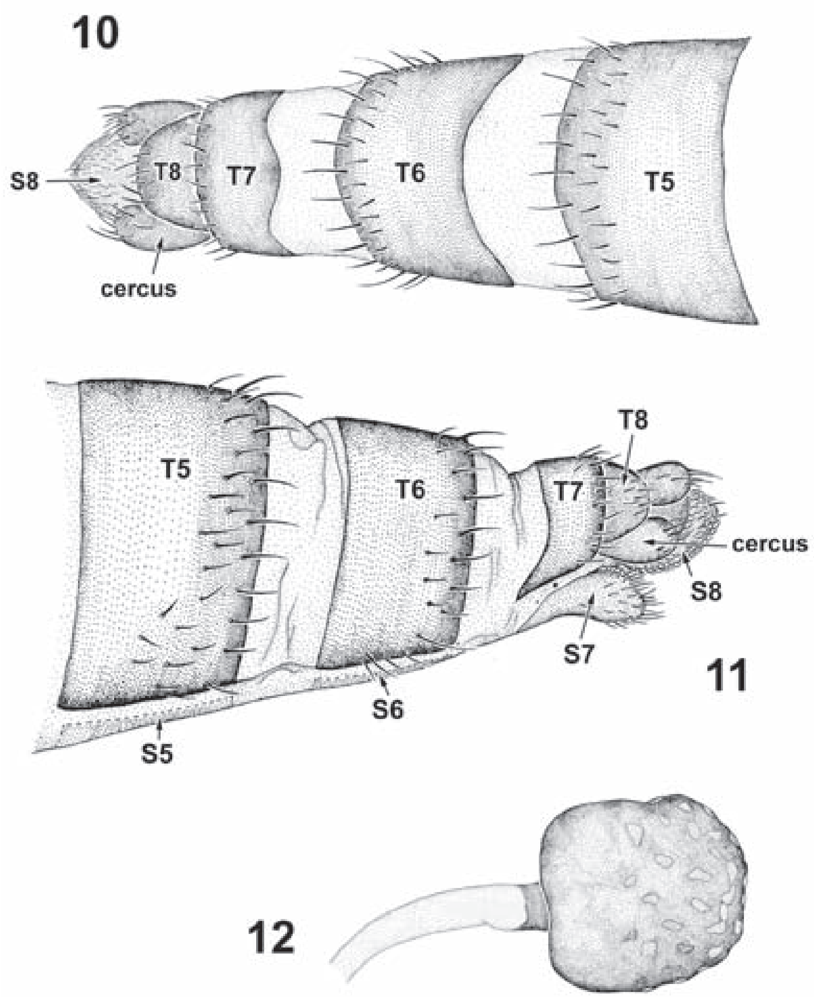

surstylus
cercus
distiphallus
gonite
7
epandrium
talon-like cerci
8
cercal spines
surstylus
hypandrium
ejaculatory apodeme
aedeagus
gonites
hypandrial spines
hypandrium
9
aedeagal apodeme

Figs 7–9. *Natalimyza milleri*, male terminalia: (7) dorsal view, including detail of all vestiture (left margin of perianal field omitted to reveal internal structures); (8) right lateral view, showing detail of epandrium, surstylus and cerci (arrows identify external structures); (9) oblique ventral view (detail of epandrium, cerci, surstyli and other dorsal structures omitted).

Thorax: Three sternopleurals, but occasionally an additional anterior bristle; anterior bristle the shortest, and the posterior the longest. Four well developed dorsocentrals (one presutural and three postsutural); prescutellar pair reaching almost twice length of either of the anterior two pairs. Posterior intra-alar present. Prescutellar acrostichals absent. Mesoscutal setulae irregularly distributed, never in distinct rows. Basal scutellars one-third to one-half length of apicals. Legs: hind basitarsus slightly to noticeably longer than mid basitarsus. Wing (Fig. 4): dorsal costagial bristle 1.0–1.5 times length of ventral bristle. Costa extending to apex of vein R_{4+5} or just beyond, macrotrichia in basal half of wing usually shortest opposite subcostal cell and longest between insertion of subcosta and apex of vein R_1; distance on margin between veins R_{2+3} and R_{4+5} one-third to one half that between veins R_{4+5} and M_1. Crossveins r–m and m–cu relatively well separated, distance between them 1.0–1.7 times length of m–cu; m–cu is positioned at basal one-third to three-sevenths of wing.

Male postabdomen (Figs 5–9): Protandrial sclerites (Figs 5, 6): Tergite 6 relatively broad and well developed, length about half to two-thirds that of tergite 5; setulae distributed mainly near right posterior margin. Sternites 6 and 7 with setulae always lacking on about anterior one-third. A slender vestige (probably of tergite 7), evident at right hand side, lacking setulae. Sternite 8 with setulae over much of surface. Spiracles positioned as in Fig. 6. Terminalia (Figs 7–9): Epandrium unremarkable, marginal projections or other modification lacking; setulae irregularly distributed, outstanding setulae or bristle(s) absent. Surstylus prominent in profile, relatively broad at base, but with apicoventral section broadly concave such that apical half is narrowed; apex acutely rounded; a cluster of setulae often present near inner basoventral margin, sometimes a few short scattered setulae on outer, apical one-third to two-fifths. Cercus arising near base of surstylus in profile and largely exposed above it, although part of apical one-quarter concealed by surstylus apex; shape unusual and complex, broadest at base, but more distally resembling a downwardly directed talon with apical region posteriorly directed and bearing two conspicuous dark, slender, apical spines; setulae relatively elongate and backwardly directed near posterior margin, thereafter much shorter and largely confined to inner margin as a medially directed series along much of length. Hypandrium U-shaped, presenting as paired sclerites united anteriorly; laterally with a posteriorly directed, short, bluntly tapered lobe on each side; paired, usually medioventrally directed, sharply pointed, black spines present on each side near anterior end (occasionally a small supernumerary present), these not arising from protrusions on cuticle, slightly to noticeably longer than cercal spines and one typically slightly shorter than the other. Gonites slender and relatively sharply pointed apically, upcurved posteriorly in profile, closely flanking basiphallus. Aedeagal apodeme very short, posteriorly directed, length at most twice that of hypandrial spines.

Female postabdomen (Figs 10–12): Tergite 6 with short bristles differentiated along posterior margin, and with a few short setulae distributed just anterior to this. Tergite 7 well developed, posterior margin virtually straight, vestiture similar to Tergite 6. Tergite 8 relatively well sclerotised, short setulae present near posterior margin. Cerci posteriorly directed, broader basally, length slightly more than maximum width. Sternites 6 and 7 with irregularly distributed setulae over posterior one-third. Sternite 8 with profuse, short vestiture over much of surface. Epiproct evident as an inconspicuous transverse



Figs 10–12. *Natalimyza milleri*, female postabdomen: (10, 11) segments five to eight and cerci: (10) dorsal view (hypoproct omitted), (11) profile, slightly oblique to show detail of apical structures, vestiture of sternites 5 and 6 omitted (epiproct concealed beneath tergite 8); (12) spermatheca and apical section of spermathecal duct.

vestige between cercal bases; with a few medial setulae. Hypoproct small, inconspicuous. Spermathecae relatively large, subspheroid, duct gradually widened apically and not inflexed into base of vesicle; surface of vesicle inconspicuously punctate, especially on extremity opposite entry of duct.

Holotype: SOUTH AFRICA: *KwaZulu-Natal*: ♂ 'S. AFRICA: Natal / Van Reenen / 28°22'S:29°23'E 1940m / 21–25. iii. 1984 / P. Stabbins & R. Miller // HOLOTYPE ♂ / *Natalimyza milleri* / Barraclough & McAlpine' [second label with red circumference]. In good condition.

Paratypes: 8♂ 37♀ with same data as holotype; 2♂ 4♀ Van Reenen's Pass, Windy Corner, 2829Ad, 25.iii.1984, alt. 1680 m, Raymond M. Miller & Patricia A. Stabbins; 3♂ 1♀ Giant's Castle Game Reserve, 2929Ab, 20–21.ii.1982, alt. 1900 m, grassland swale/along river, Raymond M. Miller.

Other material: 1♂ 1♀ Van Reenen's Pass, 28°22'S:29°23'E, 21–25.iii.1984, alt. 1940 m, P. Stabbins & R. Miller.

Discussion: We have seen at least four additional species from Van Reenen's Pass and Giant's Castle, three of which occur through late summer into autumn (late February to late April). The fourth is a winter species (late June), which is rapidly distinguished from all the others by having the head flattened in profile (see discussion under generic description). Two of the first-mentioned three species have talon-like male cerci comparable to those of *N. milleri*, but otherwise are readily distinguished (e.g. with distinctively shaped surstyli, differently developed and/or positioned hypandrial spines, and the apical part of the cerci not cranially directed).

There is variation in the distribution of vestiture on the surstylus, but we consider this to be intraspecific variation. There is also variation in body colouring, particularly of the thorax, which ranges from a pallid yellow-brown to a distinctly darker brown. Males of both colours have been dissected, and no discernible differences in the male terminalia were detected. A more detailed review of the KwaZulu-Natal fauna of Natalimyzidae may reveal specimens of *N. milleri* from additional localities, although the species is probably restricted to the Drakensberg.

RELATIONSHIPS

In considering the possibility of relationships between *Natalimyza* and other schizophoran superfamilies, it seems safe to eliminate first those superfamilies which disagree with *Natalimyza* in the uniform absence of vein 7 in that part of the wing lying beyond the alula, especially as there appear to be no striking morphological similarities to any of their component taxa. These are: Diopsoidea (Nothyboidea), Opomyzoidea (Agromyzoidea), Asteioidea, and the Ephydroidea (Drosophiloidea). The putative exceptions to the absence of vein 7 in the ephydroid families Curtonotidae and Cryptochetidae have been carefully investigated and found baseless. The natalimyzid combination of convergent postvertical bristles, distinct preapical dorsal tibial bristles, unbroken costa, and the characteristic arrangement of the protandrial sclerites gives an immediate additional means of separation from representatives of all such superfamilies. Those schizophoran superfamilies which show evidence of the presence of the distal section of vein 7 in their groundplans are: Conopoidea (as delimited by Colless & D.K. McAlpine 1970); Sciomyzoidea (D.K. McAlpine 1991*a*, i.e. Sciomyzoidea + Lauxanioidea of Hennig 1973 and J.F. McAlpine 1989); Heteromyzoidea[1]; Nerioidea (or Micropezoidea); Chloropoidea (see D.K. McAlpine 1982); Tephritoidea (see J.F. McAlpine 1989); Muscoidea (see Hennig 1958). *Natalimyza* cannot belong in the Conopoidea because it lacks the characteristic elongate proboscis with attenuated labella, it has a normal notopleural region, it has not lost the mid-coxal prong, veins R_{4+5} and M_1 are not convergent, the anal cell is not long and pointed, and the male postabdomen is not symmetrical.

Natalimyza is less strongly differentiated from the Heteromyzoidea (= Heleomyzoidea), particularly as it has the combination of convergent postvertical bristles, often more or less differentiated vibrissa, and distinct preapical dorsal tibial bristles, which, though rather characteristic of Heteromyzoidea, occurs elsewhere (e.g. some

---

[1] The superfamily Heteromyzoidea [synonyms being the Heleomyzoidea as delimited by Colless & D.K. McAlpine (1970) and the Sphaeroceroidea of J.F. McAlpine (1989)] and the family Heteromyzidae (including Heleomyzidae *s.l.* and the Sphaeroceridae of recent authors) are used in the revised sense of D.K. McAlpine (MS submitted for publication). This is the simplest means of combining phylogenetic consistency with nomenclatural priority under the International Code of Zoological Nomenclature.

Drosophilidae, very few Lauxaniidae). Unlike *Natalimyza*, the Heteromyzoidea have almost invariably the costa broken at the subcostal position, and the mid basitarsus at least slightly more elongate than the hind basitarsus. Some chyromyids, among forms sometimes placed in the Heteromyzoidea, have lost the costal break, but these are reduced types of minute size and do not otherwise approach *Natalimyza*. A rapid comparison of *Natalimyza* and the Chyromyidae gives a further 10 apparent groundplan differences between the two groups, which need not be detailed here.

The only heteromyzoids with a visible distal section of vein 7 are found in certain taxa of the family Heteromyzidae (or Heleomyzidae *s.l.*). Almost throughout this family a well sclerotised distal section of vein 6 is present and, in those taxa with vein 7 visible beyond the alula, vein 6 is long, reaching the margin or almost so; reduction of veins in this part of the wing always entails loss of the distal section of vein 7 before any notable reduction of vein 6. Thus *Natalimyza* presents a reduction pattern in the anal veins which is unlike any of the varied types currently included in Heteromyzoidea. Taking this together with the above anomalous character states, we feel it to be improbable that *Natalimyza* belongs in the Heteromyzoidea.

The phylogeny and relationships of the Nerioidea have been under study (see particularly D.K. McAlpine 1996). The postabdominal morphology of both males and females of *Natalimyza* cannot be derived from that of the groundplan of the Nerioidea. Also, typical preapical dorsal tibial bristles, like those present in *Natalimyza*, are absent in the Nerioidea, though there are several scattered dorsal tibial bristles present in some nerioid taxa. No other special points of resemblance have been found, and the Nerioidea can reasonably be eliminated from the taxa likely to be closely related to *Natalimyza*.

The Chloropoidea (*sensu* D.K. McAlpine 1982) includes taxa, such as certain of the Milichiidae and Canacidae, with vein 6 very curtailed beyond the anal cell and vein 7 visibly developed as in *Natalimyza*. However, the following character combination in *Natalimyza* indicates that any close relationship to the chloropoid families is unlikely: costa unbroken; subcostal cell sclerotised distally; each tibia with one distinct preapical dorsal bristle; prosternum quite narrow. The families of Chloropoidea have received different treatment by Brake (2000) and Buck (2006), and we are not entirely in agreement with some of their reasoning and conclusions. The points of disagreement have little relevance to the present discussion.

The superfamily Tephritoidea is most significantly characterised by the modifications of the female postabdomen (J.F. McAlpine 1989). *Natalimyza* lacks these modifications and retains a much more plesiomorphic female postabdomen. In the absence of any other notable points of resemblance, *Natalimyza* can be safely excluded from the Tephritoidea.

The Muscoidea (*sensu* Hennig 1958 or Calyptratae of J.F. McAlpine 1989) have been apportioned a large number of groundplan character states by J.F. McAlpine. Evaluation of many of these will depend on future investigation, but at least the following appear to have diagnostic value at present: frons with continuous sclerotised fronto-orbital plates connecting vertex to parafacial and bearing a series of incurved bristles anteriorly; antennal segment 2 with dorsal longitudinal seam or slit; mesoscutum with transverse suture of each side prolonged medially as a groove; preabdominal spiracles situated in tergites; sternite 5 of male bifid. As *Natalimyza* has none of these features, it is certainly excluded from the Muscoidea.

Natalimyza possesses a character state combination which is more readily reconcilable with the Sciomyzoidea than with other schizophoran superfamilies. The following natalimyzid features are particularly relevant: incurved lower fronto-orbital bristles absent; antennal segment 2 without dorsal slit; preapical dorsal bristle present on all tibiae; lower calypter not forming a lobe; costa unbroken; subcosta complete distally, diverging from vein R_1; anal and second basal cells complete; vein 7 discernible well beyond alula; male postabdomen with abdominal sternites 6 and 7 displaced towards left side, with aedeagus short, not coiled; female postabdomen without any postabdominal segments modified to form an ovipositor or ovipositor sheath, with cerci separate.

Natalimyza differs from most Sciomyzoidea in having the mid and hind basitarsi similarly slender and the former usually slightly to noticeably shorter than the latter. Typical sciomyzoid families (like heteromyzoid families) have the mid basitarsus more elongate (either longer or more slender or both) than the hind basitarsus, but this feature is variable in some sciomyzoid families.

The points of agreement with the Sciomyzoidea may not provide very strong evidence for relationship between *Natalimyza* and the other families classed in Sciomyzoidea, because the above character states are either apparently plesiomorphic for the Schizophora or occur in representatives of some other schizophoran superfamilies. However, this combination of character states does not occur in any other superfamily. Also the limits of the Sciomyzoidea are not agreed upon, and it is very difficult to define the superfamily by means of sound apomorphic character states (see also Yeates & Wiegmann 2005: 30). The sciomyzoid families are associated together largely because they span a gradation of character state combinations, which causes difficulty in demarcating narrower groupings. D.K. McAlpine (1991*a, b*) discussed some of the difficulties, and adopted a broader scope for the Sciomyzoidea to include the Lauxanioidea as defined by Hennig (1958) and J.F. McAlpine (1989).

The wider superfamily Sciomyzoidea as here delimited includes the following families: Sciomyzidae (possibly including Phaeomyiidae), Huttoninidae, Helosciomyzidae, Heterocheilidae, Dryomyzidae, Helcomyzidae, Coelopidae, Sepsidae, Ropalomeridae, Eurychoromyiidae, Chamaemyiidae (possibly including Cremifaniidae) and Lauxaniidae (including Celyphidae). The last three families are placed in the Lauxanioidea by Hennig and J.F. McAlpine (see above).

The principal structural autapomorphy of the Sciomyzidae is the reduction of the prelabrum and its remoteness from the margin of the face. Also the Sciomyzidae do not have a well developed series of cheek (peristomial) bristles; the postvertical bristles are divergent or absent; the distal section of vein 6 is always sclerotised and usually reaches the margin, but if it is shortened (e.g. in *Tetanura* Fallén), the distal section of vein 7 is quite obsolete. *Natalimyza* has none of these features and cannot be associated with the Sciomyzidae.

The family Huttoninidae (restricted to New Zealand) has vein 6 well sclerotised but not reaching the margin; the distal section of vein 7 obsolete; abdominal sternite 1 vestigial or absent; abdominal tergites 1 and 2 not somewhat separated by a membranous dorsal line. *Natalimyza* has none of these huttoninid features.

The families Heterocheilidae (D.K. McAlpine 1991*b*) and Helcomyzidae are seashore inhabiting flies with the mid basitarsus markedly more elongate than the hind basitarsus, and with sclerotised prothoracic precoxal bridges, features in disagreement with

Natalimyza. The Coelopidae are also seashore flies and differ from *Natalimyza* in the terminal ventral process of the male fore basitarsus, the characteristic sternopleural bristle, sternopleural suture, and terminal tarsal segment, and the more reduced first abdominal sternite (see also D.K. McAlpine 1991*a*). The Dryomyzidae and Helosciomyzidae also have the mid basitarsus notably more elongate than the hind basitarsus, at least 3 long terminal spurs on the mid tibia, and lack a definite series of cheek bristles. The last five families (Heterocheilidae to Helosciomyzidae) further differ from *Natalimyza* in having vein 6 almost reaching the wing margin and vein R_{2+3} shorter, terminating further from the end of vein R_{4+5}.

The families Sepsidae and Ropalomeridae differ from *Natalimyza* in having a sclerotised distal section of vein 6, but no discernible distal section of vein 7, also one or more bristles on the margin of the metathoracic spiracle, and the postvertical bristles, when present, divergent. The Eurychoromyiidae also have a long vein 6, but no distal section of vein 7, and, like the Helcomyzidae, Heterocheilidae, and Ropalomeridae, have sclerotised prothoracic precoxal bridges. The only described species (from Bolivia, see J.F. McAlpine 1968), is so distinct from *Natalimyza* that detailed comparison is unnecessary.

The Lauxaniidae, like *Natalimyza*, usually have convergent postvertical bristles, one preapical dorsal tibial bristle on each tibia, a variably shortened vein 6 (though with a sclerotised distal section) and visible vein 7 (veins 6 and 7 more reduced in some lauxaniids with an exceptionally narrowed wing-base). They differ from *Natalimyza* in having the hypofacial generally broadly visible in profile, a broad prosternum, not more than 2 sternopleural bristles, a mesopleural bristle (except in the much modified Celyphinae with reduced chaetotaxy), segment 7 of female abdomen with tergite and sternite fused into a complete ring (not yet confirmed as a groundplan condition for Lauxaniidae), and the protandrium completely symmetrical. The last condition, in particular, indicates that *Natalimyza*, with its much more plesiomorphic protandrium, cannot be derived directly from the Lauxaniidae. The Tertiary fossil genera *Chamaelauxania* Hennig and *Hemilauxania* Hennig, which are referred by Hennig (1965) to the Lauxaniidae, have more than 2 sternopleural bristles, but the reference of these to Lauxaniidae is at best problematical, despite Hennig’s firm assertion. *Chamaelauxania* may be closer to the Chamaemyiidae and has the antenna, particularly the arista, resembling that of the fossil chamaemyiid *Procremifania* Hennig.

Of the sciomyzoid families, the Chamaemyiidae have the wing veins of the anal region most like those of *Natalimyza*, the distal section of vein 6 being much shortened, and that of vein 7 being distinctly curved but unpigmented. If *Chamaelauxania* preserves characters of the chamaemyiid stem group, then its resemblance to *Natalimyza* in the greater number of sternopleural bristles (but still no mesopleural), presence of preapical dorsal tibial bristles, and apparently at least one asymmetrically placed protandrial sternite might be significant. *Natalimyza* differs from living Chamaemyiidae most notably as follows (character states of Chamaemyiidae in parentheses): legs relatively long (legs shortened, probably as a groundplan apomorphy), thorax yellowish to tawny brown (thorax ashen-grey, probably as a groundplan apomorphy), preapical dorsal tibial bristles present (probably lost as a groundplan apomorphy), mid basitarsus not longer than hind basitarsus (mid basitarsus markedly longer than hind basitarsus as a groundplan plesiomorphy), segment 4 of arista desclerotised (forming a sclerotised ring as a groundplan plesiomorphy), segment 5 of arista swollen, subspherical (probably enlarged, elongate as a separate apomorphy in groundplan). The significance of these distinctions is such that *Natalimyza* cannot reasonably be included in the Chamaemyiidae.

In conclusion, based on the available data and the characters studied, we consider that no definite sister group relationship with any of the families in the wider Sciomyzoidea is suggested. We therefore consider it appropriate to treat provisionally the Natalimyzidae as *incertae sedis* within the superfamily, pending a rigorous phylogenetic study of all included families.

ACKNOWLEDGEMENTS

We thank Ms Patricia Birkett (Research Technician, Department of Natural Sciences, Natal Museum), who skilfully and accurately executed all the figures. Dr Ray Miller provided useful data and advice, and reviewed the manuscript. Dr Mikhail Mostovski (Department of Natural Sciences, Natal Museum) generously provided resources to complete this project; this paper would not have been completed without him. Dr Brian Stuckenberg encouraged and facilitated the preparation of the paper; he is thanked for providing information and reading a final draft. The School of Biological Sciences, Howard College, Durban, and in particular Prof. Rob Slotow, are thanked for logistical and other support. The input of three referees is gratefully acknowledged.

REFERENCES

BARRACLOUGH, D.A. 1994. An introductory conservation assessment of rarely encountered Diptera families in southern Africa. *In*: *Third International Congress of Dipterology, 15–19 August, Guelph,* Abstracts volume, pp. 14–15.

——1995. An illustrated identification key to the acalyptrate families (Diptera: Schizophora) occurring in southern Africa. *Annals of the Natal Museum* **36**: 97–133.

BRAKE, I. 2000. Phylogenetic systematics of Milichiidae (Diptera, Schizophora). *Entomologica Scandinavica Supplement* **57**: 1–120.

BUCK, M. 2006. A new family and genus of acalypterate flies from the Neotropical Region, with a phylogenetic analysis of Carnoidea family relationships (Diptera, Schizophora). *Systematic Entomology* **31** (3): 377–404.

COLLESS, D.H. & MCALPINE, D.K. 1970. 34. Diptera (flies). *The Insects of Australia*. Melbourne: Melbourne University Press, pp. 656–740.

GAIMARI, S.D. 2006. One less acalyptrate family? The status of Eurychoromyiidae. *In*: *6th International Congress of Dipterology, 23–28 September, Fukuoka, Japan*, Abstracts volume, pp. 80–81.

HENNIG, W., 1958. Die Familien der Diptera Schizophora und ihre phylogenetischen Verwandtschaftsbeziehungen. *Beiträge zur Entomologie* **8**: 505–688.

——1965. Die Acalyptratae des Baltischen Bernsteins und ihre Bedeutung für Erforschung der phylogenetischen Entwicklung dieser Dipteren-Gruppe. *Stuttgarter Beiträge zur Naturkunde* **145**: 1–215.

——1973. 31. Diptera (Zweiflügler). *In*: Helmcke, J.-G., Starck, D. & Wermuth, H., eds, *Handbuch der Zoologie. Eine Naturgeschichte der Stämme des Tierreiches*. 4 Band: Arthropoda, 2 Hälfte: Insecta, 2 Auflage, 2 Teil: Spezielles. Berlin: Walter de Gruyter, pp. 1–337.

MCALPINE, D.K., 1982. A new genus of Australian littoral flies (Diptera: ? Canacidae). *Memoirs of the Entomological Society of Washington* **10**: 108–117.

——1991*a*. Review of the Australian kelp flies (Diptera: Coelopidae). *Systematic Entomology* **16**: 29–84.

——1991*b*. Relationships of the genus *Heterocheila* (Diptera: Sciomyzoidea) with description of a new family. *Tijdschrift voor Entomologie* **134**: 193–199.

——1991*c*. Marginidae, a new Afrotropical family of Diptera (Schizophora: ? Opomyzoidea). *Annals of the Natal Museum* **32**: 167–177.

——1996. Relationships and classification of the Pseudopomyzidae (Diptera: Nerioidea). *Proceedings of the Linnean Society of New South Wales* **116**: 223–232.

—— (MS submitted for publication). Review of the Borboroidini or Wombat Flies (Diptera: Heteromyzidae), with reconsideration of the status of families Heleomyzidae and Sphaeroceridae, and descriptions of femoral gland-baskets.

McAlpine, J.F. 1968. Taxonomic notes on *Eurychoromyia mallea* (Diptera: Eurychoromyiidae). *The Canadian Entomologist* **100**: 819–823.

———1981. Morphology and terminology—adults. *In*: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M., eds, *Manual of Nearctic Diptera, Volume 1*. Monograph 27. Ottawa: Research Branch Agriculture Canada, pp. 9–63.

———1989. Phylogeny and classification of the Muscomorpha. *In*: McAlpine, J.F. & Wood, D.M., eds, *Manual of Nearctic Diptera, Volume 3*. Monograph 32. Ottawa: Research Branch Agriculture Canada, pp. 1397–1518.

Miller, R.M. 1984. A new acalyptrate fly from southern Africa, possibly representing a new family. *In*: *XVII International Congress of Entomology, 20–26 August, Hamburg, Federal Republic of Germany,* Abstracts volume, p. 32.

Moran, V.C. & Southwood, T.R.E. 1982. The guild composition of arthropod communities in trees. *Journal of Animal Ecology* **51**: 289–306.

Yeates, D.K. & Wiegmann, B.M. 2005. Phylogeny and evolution of Diptera: recent insights and new perspectives. *In*: Yeates, D.K. & Wiegmann, B.M., eds, *The evolutionary biology of flies*. New York: Columbia University Press, pp. 14–44.